MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

BOM 2064 – QUALITY AND OPERATIONS MANAGEMENT

(All Sections/Groups)

4 MARCH 2020
9.00a.m – 11.00a.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 7 pages with 4 questions only.
2. Attempt **ALL** the questions. The distribution of the marks for each question is provided.
3. Please write all your answers in the answer booklet provided.

QUESTION 1

a) Manufacturing and service are often different in terms of *what* is done but quite similar in terms of *how* it is done. Although goods and services often go hand in hand, there are some basic differences between the two. Discuss **FOUR (4)** points of comparison between production of goods and delivery of services. (8 marks)

b) Wonder Woman Enterprise provides housekeeping and cleaning services to households in Melaka. In September 2019, the company cleaned 100 houses with its standard crew of four cleaners. They worked for 25 days from 9.00am to 5.00pm and utilised 300 litters of cleanser to complete the jobs. In the following month, the company replaced its old cleaning equipment with newly purchased cleaning equipment. It is reported that the four cleaners cleaned 162 houses in 27 days using 405 litters of cleanser. Also, the cleaners managed to complete their daily job faster by 12.5%.

i) What is the productivity with the old cleaning equipment? *(Please give your answer in 2 decimal places)* (2 marks)

ii) What is the productivity with the new cleaning equipment? *(Please give your answer in 2 decimal places)* (2 marks)

iii) What is the change in productivity? Is the decision to purchase and use new cleaning equipment a wise one? *(Please give your answer in 2 decimal places)* (3 marks)

c) Ms. Suzanne is a young entrepreneur who owns a food truck business in Georgetown, Penang. She is interested to monitor the sales of volcano toast which has been receiving a good demand from the tourists recently. Table below shows the number of volcano toasts sold for the past 10 days.

Day	1	2	3	4	5	6	7	8	9	10
Number of Unit Sold	144	138	159	155	186	215	238	160	178	156

Predict the number of volcano toasts to be sold for the day 11 using the following methods.

i) Naïve (1 mark)
ii) A five-period moving average (2 marks)
iii) Weighted average with 0.4 (most recent), 0.3, 0.2 and 0.1. (2 marks)
iv) Exponential smoothing with $\alpha = 0.3$. Use 220 for day 6 forecast. (5 marks)

(TOTAL: 25 marks)

Continued ...

QUESTION 2

a) In a service industry, it is highly important for the service system to be well-designed. Explain **FIVE (5)** characteristics of well-designed service systems.
(10 marks)

b) Prolexus Sdn Bhd produces refrigerators and is currently in the final process of applying paint on the refrigerators. Quality control has taken samples for 20 shifts, each consisting of 5 observations (measurements shown below).

Observation / Shift	Thickness (in mm)				
1	2.7	2.3	2.6	2.4	2.7
2	2.6	2.4	2.6	2.3	2.8
3	2.3	2.3	2.4	2.5	2.4
4	2.8	2.3	2.4	2.6	2.7
5	2.6	2.5	2.6	2.1	2.8
6	2.2	2.3	2.7	2.2	2.6
7	2.2	2.6	2.4	2.0	2.3
8	2.8	2.6	2.6	2.7	2.5
9	2.4	2.8	2.4	2.2	2.3
10	2.6	2.3	2.0	2.5	2.4
11	3.1	3.0	3.5	2.8	3.0
12	2.4	2.8	2.2	2.9	2.5
13	2.1	3.2	2.5	2.6	2.8
14	2.2	2.8	2.1	2.2	2.4
15	2.4	3.0	2.5	2.5	2.0
16	3.1	2.6	2.6	2.8	2.1
17	2.9	2.4	2.9	1.3	1.8
18	1.9	1.6	2.6	3.3	3.3
19	2.3	2.6	2.7	2.8	3.2
20	1.8	2.8	2.3	2.0	2.9

Find the Lower Control Limit (LCL) and Upper Control Limit (UCL) for the range and average. Determine if the process is in control. (Note: Write your answers in nearest TWO decimals). (15 marks)

(TOTAL: 25 marks)

Continued ...

QUESTION 3

a) Prepare a cause and effect diagram to analyze the possible causes of late shipments of merchandize from a supplier. (10 marks)

b) Discuss **FIVE (5)** reasons why there is a need for supply chain management. (15 marks)

(TOTAL: 25 marks)

QUESTION 4

a) The Ayamas Sausage Factory (ASF) can produce sausages at a rate of 4000 per day. ASF supplies sausages to local restaurant at a steady rate of 200 per day. The cost to prepare the equipment for producing sausages is RM60. Annual holding costs are RM0.80 per sausage. The factory operates 320 days in a year. Find

i) The optimal run size (4 marks)
ii) The number of runs per year (2 marks)
iii) The length (in days) of a run (2 marks)

b) In the JIT philosophy, waste represents unproductive resources; eliminating waste can free up resources and enhance production. Discuss **FIVE (5)** types of waste in the JIT system. (10 marks)

c) A JIT system uses kanban cards to authorize movement of incoming parts. In one portion of the system, a work center uses an average of 120 parts per hour while running. The manager has assigned an inefficiency factor of 0.25 to the center. Standard containers are designed to hold 5 dozen parts each. The cycle time for parts containers is about 90 minutes.

i) How many containers are needed? (5 marks)
ii) What is the maximum authorized inventory? (2 marks)

(TOTAL: 25 marks)

Continued ...

RELEVANT EQUATIONS / FORMULAS

1) CL = $\overline{\overline{X}}$ UCL (R) = $D_4 \overline{R}$

UCL, LCL (X – bar) = $\overline{\overline{X}} \pm A_2 \overline{R}$ LCL (R) = $D_3 \overline{R}$

Table for X – bar & R Charts

No of Observation	A2	D3	D4
In sub group n			
2	1.88	0	3.27
3	1.02	0	2.57
4	0.73	0	2.28
5	0.58	0	2.11
6	0.48	0	2

2) UCL c = $\bar{c} + 3\sqrt{\bar{c}}$

LCL c = $\bar{c} - 3\sqrt{\bar{c}}$

3) $\bar{p}$ = Total No of Defective from All Samples/ (No of Samples X Sample Size)

$Sp = \sqrt{\bar{p}(1-\bar{p})/n}$

CL = $\bar{p}$

LCL = $\bar{p} - 3\,Sp$

UCL = $\bar{p} + 3\,Sp$

4) Capacity Utilization = Capacity Used / Best Operating Level

5) $$r = \frac{n\sum XY - [\sum X \sum Y]}{\sqrt{\left[n\sum X^2 - (\sum X)^2\right]\left[n\sum Y^2 - (\sum Y)^2\right]}}$$

$$a = \overline{Y} - b\overline{X}$$

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - \left(\sum x\right)^2}$$

6) Exponential smoothing

Forecast for the month t: $F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$

Continued ...

7) Inventory Management:

$$\text{EOQ} = Q^* = \sqrt{\frac{2DS}{H}} \qquad TC = \frac{Q}{2}H + \frac{D}{Q}S$$

$$\text{EPQ} = Q_0 = \sqrt{\frac{2DS}{H}}\sqrt{\frac{p}{p-u}} \qquad I_{\max} = \frac{Q}{P}(p-u) \qquad TC = \frac{I_{\max}}{2}\text{H} + \frac{\text{D}}{\text{Q}}\text{S}$$

$$SS = z(\sigma_d)\sqrt{LT} \quad \text{ROP} = \bar{d}LT + z\sigma_d\sqrt{LT}$$

8) Lean Operations:

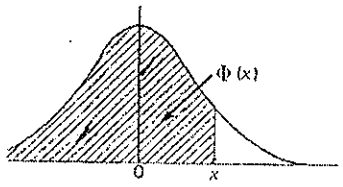
$$N = \frac{DT(1+X)}{C}$$

Continued ...

Z-TABLE

THE NORMAL DISTRIBUTION FUNCTION

The function tabulated is $\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{1}{2}t^2} dt$. $\Phi(x)$ is the probability that a random variable, normally distributed with zero mean and unit variance, will be less than or equal to x. When $x < 0$ use $\Phi(x) = 1 - \Phi(-x)$, as the normal distribution with zero mean and unit variance is symmetric about zero.



x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
0·00	0·5000	0·40	0·6554	0·80	0·7881	1·20	0·8849	1·60	0·9452	2·00	0·97725
·01	·5040	·41	·6591	·81	·7910	·21	·8869	·61	·9463	·01	·97778
·02	·5080	·42	·6628	·82	·7939	·22	·8888	·62	·9474	·02	·97831
·03	·5120	·43	·6664	·83	·7967	·23	·8907	·63	·9484	·03	·97882
·04	·5160	·44	·6700	·84	·7995	·24	·8925	·64	·9495	·04	·97932
0·05	0·5199	0·45	0·6736	0·85	0·8023	1·25	0·8944	1·65	0·9505	2·05	0·97982
·06	·5239	·46	·6772	·86	·8051	·26	·8962	·66	·9515	·06	·98030
·07	·5279	·47	·6808	·87	·8078	·27	·8980	·67	·9525	·07	·98077
·08	·5319	·48	·6844	·88	·8106	·28	·8997	·68	·9535	·08	·98124
·09	·5359	·49	·6879	·89	·8133	·29	·9015	·69	·9545	·09	·98169
0·10	0·5398	0·50	0·6915	0·90	0·8159	1·30	0·9032	1·70	0·9554	2·10	0·98214
·11	·5438	·51	·6950	·91	·8186	·31	·9049	·71	·9564	·11	·98257
·12	·5478	·52	·6985	·92	·8212	·32	·9066	·72	·9573	·12	·98300
·13	·5517	·53	·7019	·93	·8238	·33	·9082	·73	·9582	·13	·98341
·14	·5557	·54	·7054	·94	·8264	·34	·9099	·74	·9591	·14	·98382
0·15	0·5596	0·55	0·7088	0·95	0·8289	1·35	0·9115	1·75	0·9599	2·15	0·98422
·16	·5636	·56	·7123	·96	·8315	·36	·9131	·76	·9608	·16	·98461
·17	·5675	·57	·7157	·97	·8340	·37	·9147	·77	·9616	·17	·98500
·18	·5714	·58	·7190	·98	·8365	·38	·9162	·78	·9625	·18	·98537
·19	·5753	·59	·7224	·99	·8389	·39	·9177	·79	·9633	·19	·98574
0·20	0·5793	0·60	0·7257	1·00	0·8413	1·40	0·9192	1·80	0·9641	2·20	0·98610
·21	·5832	·61	·7291	·01	·8438	·41	·9207	·81	·9649	·21	·98645
·22	·5871	·62	·7324	·02	·8461	·42	·9222	·82	·9656	·22	·98679
·23	·5910	·63	·7357	·03	·8485	·43	·9236	·83	·9664	·23	·98713
·24	·5948	·64	·7389	·04	·8508	·44	·9251	·84	·9671	·24	·98745
0·25	0·5987	0·65	0·7422	1·05	0·8531	1·45	0·9265	1·85	0·9678	2·25	0·98778
·26	·6026	·66	·7454	·06	·8554	·46	·9279	·86	·9686	·26	·98809
·27	·6064	·67	·7486	·07	·8577	·47	·9292	·87	·9693	·27	·98840
·28	·6103	·68	·7517	·08	·8599	·48	·9306	·88	·9699	·28	·98870
·29	·6141	·69	·7549	·09	·8621	·49	·9319	·89	·9706	·29	·98899
0·30	0·6179	0·70	0·7580	1·10	0·8643	1·50	0·9332	1·90	0·9713	2·30	0·98928
·31	·6217	·71	·7611	·11	·8665	·51	·9345	·91	·9719	·31	·98956
·32	·6255	·72	·7642	·12	·8686	·52	·9357	·92	·9726	·32	·98983
·33	·6293	·73	·7673	·13	·8708	·53	·9370	·93	·9732	·33	·99010
·34	·6331	·74	·7704	·14	·8729	·54	·9382	·94	·9738	·34	·99036
0·35	0·6368	0·75	0·7734	1·15	0·8749	1·55	0·9394	1·95	0·9744	2·35	0·99061
·36	·6406	·76	·7764	·16	·8770	·56	·9406	·96	·9750	·36	·99086
·37	·6443	·77	·7794	·17	·8790	·57	·9418	·97	·9756	·37	·99111
·38	·6480	·78	·7823	·18	·8810	·58	·9429	·98	·9761	·38	·99134
·39	·6517	·79	·7852	·19	·8830	·59	·9441	·99	·9767	·39	·99158
0·40	0·6554	0·80	0·7881	1·20	0·8849	1·60	0·9452	2·00	0·9772	2·40	0·99180

Continued ...

THE NORMAL DISTRIBUTION FUNCTION

x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
2·40	0·99180	2·55	0·99461	2·70	0·99653	2·85	0·99781	3·00	0·99865	3·15	0·99918
·41	·99202	·56	·99477	·71	·99664	·86	·99788	·01	·99869	·16	·99921
·42	·99224	·57	·99492	·72	·99674	·87	·99795	·02	·99874	·17	·99924
·43	·99245	·58	·99506	·73	·99683	·88	·99801	·03	·99878	·18	·99926
·44	·99266	·59	·99520	·74	·99693	·89	·99807	·04	·99882	·19	·99929
2·45	0·99286	2·60	0·99534	2·75	0·99702	2·90	0·99813	3·05	0·99886	3·20	0·99931
·46	·99305	·61	·99547	·76	·99711	·91	·99819	·06	·99889	·21	·99934
·47	·99324	·62	·99560	·77	·99720	·92	·99825	·07	·99893	·22	·99936
·48	·99343	·63	·99573	·78	·99728	·93	·99831	·08	·99896	·23	·99938
·49	·99361	·64	·99585	·79	·99736	·94	·99836	·09	·99900	·24	·99940
2·50	0·99379	2·65	0·99598	2·80	0·99744	2·95	0·99841	3·10	0·99903	3·25	0·99942
·51	·99396	·66	·99609	·81	·99752	·96	·99846	·11	·99906	·26	·99944
·52	·99413	·67	·99621	·82	·99760	·97	·99851	·12	·99910	·27	·99946
·53	·99430	·68	·99632	·83	·99767	·98	·99856	·13	·99913	·28	·99948
·54	·99446	·69	·99643	·84	·99774	·99	·99861	·14	·99916	·29	·99950
2·55	0·99461	2·70	0·99653	2·85	0·99781	3·00	0·99865	3·15	0·99918	3·30	0·99952

The critical table below gives on the left the range of values of x for which $\Phi(x)$ takes the value on the right, correct to the last figure given; in critical cases, take the upper of the two values of $\Phi(x)$ indicated.

3·075	0·9990	3·263	0·9994	3·731	0·99990	3·916	0·99995
3·105	0·9991	3·320	0·9995	3·759	0·99991	3·976	0·99996
3·138	0·9992	3·389	0·9996	3·791	0·99992	4·055	0·99997
3·174	0·9993	3·480	0·9997	3·826	0·99993	4·173	0·99998
3·215	0·9994	3·615	0·9998	3·867	0·99994	4·417	0·99999
			0·9999		0·99995		1·00000

When $x > 3{\cdot}3$ the formula $1 - \Phi(x) \doteqdot \dfrac{e^{-\frac{1}{2}x^2}}{x\sqrt{2\pi}}\left[1 - \dfrac{1}{x^2} + \dfrac{3}{x^4} - \dfrac{15}{x^6} + \dfrac{105}{x^8}\right]$ is very accurate, with relative error less than $945/x^{10}$.